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ABSTRACT

This paper describes an experiment that investigated the effects of goals and self-evaluation on self-regulation processes and achievement outcomes of (n=44) fourth grade students who received instruction and practice on fraction operations. Half of the students were provided with the goal of learning how to solve problems (learning goal) and the other half were given a goal of solving problems (performance goal). Within each goal condition, half of the students regularly assessed their problem-solving capabilities. Providing a learning goal with or without opportunities for self-evaluation or a performance goal with self-evaluation led to higher self-regulated performance, self-efficacy, skill, and task orientation, as well as lower ego orientation, compared with providing a performance goal without self-evaluation. The learning goal with self-evaluation led to greater persistence than the performance goal without self-evaluation. Task orientation correlated positively with self-efficacy and skill, and ego orientation related negatively to these measures. Implications of the results for educational practice are discussed. Contains 34 references. (Author/MKR)

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Abstract

This experiment investigated the effects of goals and self-evaluation on self-regulation processes and achievement outcomes. Fourth grade students received instruction and practice on fractions operations. Half of the students were provided with the goal of learning how to solve problems (learning goal); the other half were given a goal of solving problems (performance goal). Within each goal condition, half of the students regularly assessed their problem-solving capabilities. Providing a learning goal with or without opportunities for self-evaluation or a performance goal with self-evaluation led to higher self-regulated performance, self-efficacy, skill, and task orientation, as well as lower ego orientation, compared with providing a performance goal without self-evaluation. The learning goal with self-evaluation led to greater persistence than the performance goal without self-evaluation. Task orientation correlated positively with self-efficacy and skill; ego orientation related negatively to these measures. Implications of the results for educational practice are discussed.

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Goal and Self-Evaluative Influences During Children's Mathematical Skill Acquisition

A topic assuming increasing importance in education is learners' self-regulation of their cognitions, motivation, and behaviors, to promote academic achievement (Zimmerman, 1989, 1990a, 1990b). According to Bandura (1986, 1991b), self-regulation involves self-observation, self-judgment, and self-reaction. Self-observation refers to deliberate attention to aspects of one's behavior to include their determinants and effects. Self-judgment entails assessing one's present performance level, such as by comparing it with one's goal to determine progress. Self-reaction refers to people's evaluations of their performances as good/bad, satisfactory/unsatisfactory, and so forth (Schunk, 1990).

This conceptualization postulates a central mediating role for perceptions of self-efficacy, or personal beliefs about one's capabilities to learn or perform skills at designated levels. Learners acquire information to appraise self-efficacy from their performance accomplishments, vicarious (observational) experiences, forms of persuasion, and physiological reactions (e.g., sweating, heart rate). Self-efficacy can influence self-regulation: Students who feel efficacious about learning choose to engage in tasks, select effective strategies, expend effort, and persist when difficulties are encountered (Bandura, 1989; Schunk, 1991; Zimmerman, 1989). In turn, these self-regulatory activities can affect self-efficacy. As students work on tasks they observe their performances, compare them with their goals, and judge and evaluate their progress. Positive judgments and evaluations enhance self-efficacy and motivation (Bandura, 1991a).

Two central components of this model of self-regulation are the goals that people set for themselves and their self-evaluations of their attainments (Bandura, 1991a, 1991b). The purpose of the present study was to explore the operation of goals and self-evaluation among children during cognitive skill learning and, within this context, investigate the influence of perceived self-efficacy.

Goals provide standards against which people compare their present performances (Bandura, 1986). Goals motivate and inform people about their capabilities (Locke & Latham, 1990). When students adopt a goal they may experience a sense of efficacy for attaining it, which motivates them to engage in appropriate activities, attend to instruction, persist, and expend effort. Students' initial self-efficacy is substantiated as they observe their goal progress because perceptions of progress convey they are becoming skillful. Self-efficacy sustains motivation and leads learners to establish new goals when they master their present ones (Bandura, 1988; Schunk, 1991).

Goals do not automatically enhance performances; rather, certain goal properties are important (Locke, Shaw, Saari, & Latham, 1981). Goals that incorporate specific performance standards, are close at hand, and are moderately difficult, are more likely to enhance performance than goals that are general, extend into the distant future, or are perceived as very easy or overly difficult (Bandura, 1988; Locke & Latham, 1990; Schunk, 1990, 1991).

Goal effects also may depend on whether the goal denotes a learning or performance outcome (Meece, 1991). A learning goal refers to what knowledge and skills students are to acquire; a performance goal denotes what task

students are to complete (Dweck & Leggett, 1988). Goal setting research typically has focused on such goals as rate or quantity of performance, but educators increasingly are advocating greater emphasis on learning processes and strategies (Weinstein, Goetz, & Alexander, 1988).

Learning and performance goals may exert different effects on self-regulatory activities even when the goals are similar in properties (specificity, proximity, difficulty) (Schunk & Swartz, 1993). Learning goals focus students' attention on processes and strategies that help them acquire capabilities and improve their skills (Ames, 1992). Students who adopt learning goals are apt to experience an initial sense of self-efficacy for skill improvement and engage in activities they believe will enhance learning (e.g., expend effort, persist, use effective strategies) (Bandura, 1986; Schunk, 1989). Learners' self-efficacy is substantiated as they work on the task and compare their present and past performances to determine progress (Wentzel, 1992). Perceived improvement in capabilities and self-efficacy for continued learning sustain self-regulatory activities and enhance academic performance (Schunk, 1991).

In contrast, performance goals focus students' attention on completing tasks. Such goals may not highlight the importance of the processes and strategies underlying completion of the tasks and are not likely to raise self-efficacy for learning new skills (Schunk & Swartz, 1993). As students work on the tasks, they may compare their performances with those of other students instead of with their own prior efforts (Wentzel, 1992). These social comparisons result in low perceptions of ability among students who experience difficulties (Ames, 1992; Jagacinski, 1992). Performance goals may motivate students to complete short-term tasks, but unless students acquire a sense of self-efficacy for learning they are unlikely to display the sustained self-regulatory activities that can result from learning goals (Schunk & Swartz, 1993).

Research testing these ideas has yielded mixed evidence (Elliott & Dweck, 1988; Meece, Blumenfeld, & Hoyle, 1988; Schunk & Swartz, 1993). Inconsistencies in research results are difficult to resolve because studies differ in type of subjects, assessments, experimental content, and instructional procedures. The present study examined the effects of learning and performance goals during children's learning of fraction operations. There is little research on learning and performance goals during mathematics learning; however, many students find mathematics difficult and doubt their capabilities to perform well. Providing students with a learning goal, instruction, and practice on problem-solving strategies would seem to be an effective means for enhancing self-efficacy, skills, and self-regulatory activities (Schunk, 1991). It was hypothesized that learning goals would lead to higher achievement outcomes and would raise students' task orientation better than performance goals, because the former goals emphasize progress, the development of competence, and the importance of strategies for improving skills.

Self-evaluation of one's attainments is another important self-regulatory process. Cognitive comparisons of present performance with a goal produce judgments of progress and enhanced perceptions of capabilities. When students evaluate their performances as satisfactory their initial sense of self-efficacy is substantiated and their motivation to continue to improve is sustained. Self-evaluations of performance as deficient will not necessarily

lower self-efficacy and motivation if students believe that they are capable of succeeding but that their present approach is ineffective (Bandura, 1986). Such students may work harder, persist longer, adopt what they believe is a better strategy, or seek help from teachers or peers (Schunk, 1990). These and other self-regulatory activities are likely to lead to success (Zimmerman & Martinez-Pons, 1992).

The activation of self-evaluative processes through cognitive comparisons requires both comparative factors--a personal standard and knowledge of one's performance level (Bandura, 1991a, 1991b). Bandura and Cervone (1983) obtained benefits of goals and self-evaluative feedback with college students. The situation may be less clear-cut with children. Children become increasingly capable of making reasonably accurate self-evaluations with development (Stipek & Mac Iver, 1989), but children's judgments often are not accurate and they may not automatically make such judgments. Students typically are not asked to assess their skills but rather receive regular assessments from teachers and parents. Having students periodically assess their capabilities might be an exceptionally helpful way to improve their self-evaluative skills and foster learning.

Research has not addressed the effects on achievement outcomes of having children periodically evaluate their capabilities, although other evidence provides indirect support. Research with children during learning of mathematical and writing skills shows that measures of self-efficacy for learning collected prior to participation in an instructional program predict subsequent motivation and skill acquisition (Schunk, 1989, 1990, 1991; Schunk & Swartz, 1993). Masters and Santrock (1976) found that preschoolers who verbalized self-judgmental statements during performance of an effortful handle-turning task (e.g., "I'm really good at this") persisted longer than children who verbalized self-critical or neutral statements.

In the present study, half of the students in the learning and performance goal conditions regularly assessed their capabilities during the instructional sessions. Based on the preceding ideas, it was hypothesized that this self-evaluation treatment would prove more effective than no self-evaluation and that combining learning goals with self-evaluation would result in the highest achievement outcomes. To the extent that learning goals produce a long-term focus on skill improvement, periodic self-evaluation should highlight to students that they are making progress in skill acquisition. Given that students who receive performance goals might not have the same type of focus on skill improvement, the addition of a self-evaluative component might not enhance motivation and self-efficacy.

Method

Subjects

The final sample included 44 fourth-grade students drawn from two classes in one elementary school. The 18 girls and 26 boys ranged in age from 9 years 1 month to 10 years 10 months (M = 9.8 years). Although different socioeconomic backgrounds were represented, children predominantly were middle class. Ethnic composition was 24 White and 20 African American students. Initially 46 students were included, but one student was dropped because he missed some instructional sessions and one other student's data were discarded to equalize cell sizes. Students were considered by school personnel to be

average achievers in mathematics and received mathematics instruction in regular classes.

Pretest

The pretest was administered by a tester from outside the school. It comprised measures of goal orientation, self-efficacy, skill, and persistence.

Goal orientation. This inventory included 18 items adapted from Meece et al. (1988). Each item tapped one of four goal orientations (number of items and sample item in parentheses): task--desire to independently master and understand academic work (5 items, "I want to do better than I have done before"); ego—desire to perform well to please the teacher and avoid trouble (4 items, "I want the teacher to think I am doing a good job"); affiliative—desire to share ideas and work with peers (4 items, "I want to work with my friends"); work avoidant--desire to accomplish academic work with minimum effort (5 items, "I want to do as little work as possible"). Children decided how well each item described how they usually felt during mathematics and judged it on a 10-point scale ranging from 10—not at all, to 100--very much. The reliability of the goal inventory was assessed during a pilot study with 10 children comparable to the present sample but who did not participate in the study. Children completed the instruments twice, two weeks apart. Test-retest coefficients were: .82 (task), .75 (ego), .77 (affiliative), .71 (work avoidant).

Self-efficacy. The self-efficacy test assessed children's perceived capabilities for correctly solving types of fraction problems. The scale ranged in 10-unit intervals from 10—not sure, to 100—really sure. The stimulus materials comprised 31 sample pairs of problems. The two problems constituting each pair were similar in form and operations required and corresponded to one problem on the skill test although they involved different numbers. The reliability of the efficacy test was assessed during the pilot study; test-retest r = .81.

Children received practice using the self-efficacy scale and then were shown briefly each pair of fraction problems to allow assessment of problem difficulty but not actual solutions. After viewing each pair, children judged their certainty of solving problems of that type (e.g., same form, requiring the same operations, comparable in difficulty). Children marked the efficacy value that corresponded to how they felt. The 31 scores were summed and averaged.

Skill and persistence. The skill test comprised 31 problems that tapped addition and subtraction of fractions in six different categories (number of problems and sample problem in parentheses): addition, like denominators, no carrying (5 problems, 1/6 + 4/6); addition, like denominators, carrying (5 problems, 9/10 + 5/10); addition, unlike denominators, no carrying (6 problems, 5/16 + 2/4); addition, unlike denominators, carrying (6 problems, 11/15 + 37/45); subtraction, like denominators, no regrouping (3 problems, 7/9 - 3/9); subtraction, unlike denominators, no regrouping (6 problems, 21/36 - 8/18). About 70% of these problems were similar to those children solved during the instructional sessions; the others were more complex. Different forms of the skill test were used on the pretest and posttest to eliminate effects due to problem familiarity (pilot study parallel forms r = .85).

The tester presented problems to children one at a time. For each problem children decided whether to attempt it and how long to work on it. Children were given no feedback on solution accuracy. The measure of skill was the number of problems solved correctly. The tester also recorded the length of time children spent solving problems as a measure of persistence.

Instructional Program

Children were assigned randomly within gender, ethnic background, and classroom, to one of four experimental conditions: learning goal with self-evaluation (LG-SE), learning goal without self-evaluation (LG-NoSE), performance goal with self-evaluation (PG-SE), performance goal without self-evaluation (PG-NoSE). Students received 45-minute instructional sessions over seven school days. Children assigned to the same condition met in small groups with one of two female teachers from outside the school. For any given child, the same teacher administered all seven sessions but did not administer his or her pretest. Each teacher worked with all four experimental conditions.

There were seven packets of instructional materials, one for each session. Six of these packets covered the six major types of fraction skills described above and the final packet contained review material. The format of the seven packets was identical. The first page contained an explanation of the relevant operations, along with examples illustrating their application. Each of the following pages contained several similar problems to be solved using the depicted steps. Each set included sufficient problems so that children could not complete all of them during the session.

At the start of each session, the teacher gave the goal instructions appropriate for children's condition, after which she verbally explained and demonstrated the relevant fraction operations by referring to the explanatory page and by illustrating examples on the board. After this modeled demonstration phase (about 10 min), students engaged in a hands-on activity with manipulatives and cutouts and solved a few practice problems in the teacher's presence (guided practice, about 10 min). Once the teacher was satisfied that children understood what to do, children solved problems alone during independent practice for the remainder of the session (25 min). It was felt that 25 min per session was sufficient to allow for demonstration of differences in self-regulatory processes brought about by the goal and self-evaluation treatments.

Experimental Conditions

Goals. At the start of the first instructional session the teacher said to students assigned to the LG-SE and LG-NoSE conditions:

> While you're working it helps to keep in mind what you're trying to do. You'll be trying to learn how to solve fraction problems where the denominators are the same and you have to add the numerators.

These instructions stressed that students' goal was to learn how to solve the problems rather than simply to solve them. These instructions were identical for the other sessions except that the teacher substituted the name of the fraction skill they would be covering during that session.

Children assigned to the PG-SE and PG-NoSE conditions were told at the start of the first instructional session:

While you're working it helps to keep in mind what you're trying to do. You'll be trying to solve fraction problems where the denominators are the same and you have to add the numerators.

These instructions did not explicitly mention learning. For the remaining sessions the teacher substituted the name of the fraction skill to be covered during that session.

Self-Evaluation. Children assigned to the LG-SE and PG-SE conditions judged their fraction capabilities at the end of each of the first six sessions. The materials and procedure were identical to those of the pretest self-efficacy assessment except that children judged how certain they were that they could solve the types of fraction problems that were covered during that session. Children did not make judgments at the end of the seventh (review) session.

Children assigned to the LG-NoSE and PG-NoSE conditions did not evaluate their capabilities at the end of the sessions. Instead, these children completed a one-item attitude question ("How much do you like to work fraction problems?") at the end of the first six sessions to control for potential effects of making judgments. Attitude judgments of these two conditions did not differ significantly ($F < 1$). These judgments are not otherwise important and are not discussed further.

Posttest

The posttest was given on the day after the last instructional session. It included goal orientation, self-efficacy, skill, and persistence. Assessments were identical to those on the pretest except that the parallel form of the skill test was used to control for potential effects of children's selective memory of pretest problems. For any given child, the tester was unaware of the child's experimental assignment and performance during the instructional program. Tests and instructional materials were scored by an adult who had not participated in the data collection and was unaware of children's experimental assignments.

Results

Means and standard deviations are presented by condition in Table 1. Preliminary analyses of variance (ANOVAs) yielded no significant between-conditions differences on pretest measures. There also were no significant differences on any measure due to gender, ethnic background, or classroom.

Insert Table 1 about here

Self-Efficacy, Skill, Persistence

Intracondition changes (pretest to posttest) on self-efficacy, skill, and persistence, were evaluated using the t test for correlated scores (Winer, 1971). All conditions showed increases in self-efficacy and skill (range of $t(10)$ values = 3.96 to 12.86, $ps < .001$, except $p < .01$ for the PG-NoSE condition on both measures). LG-SE students showed a significant increase in persistence, $t(10) = 3.68$, $p < .01$.

Posttest self-efficacy, skill, and persistence, were analyzed with a multivariate analysis of covariance (MANCOVA) according to a 2 (goal: learning/performance) x 2 (self-evaluation: yes/no) factorial design with the corresponding pretest measures as covariates. This analysis yielded an effect due to self-evaluation, Wilks's lambda = .703, $F(3, 35) = 4.92$, $p < .01$, as well as a goal x self-evaluation interaction, lambda = .701, $F(3, 35) = 4.97$, $p < .01$.

Analysis of covariance (ANCOVA) was applied to each posttest measure using the corresponding pretest measure as covariate. For self-efficacy there was an effect due to self-evaluation, $F(1, 39) = 13.85$, $p < .01$, and a goal x self-evaluation interaction, $F(1, 39) = 7.10$, $p < .05$ ($MS_e = 148.75$). Skill yielded significance for type of goal, $F(1, 39) = 4.37$, $p < .05$, and for self-evaluation, $F(1, 39) = 6.89$, $p < .05$ ($MS_e = 15.58$). An effect due to self-evaluation was obtained on the persistence measure, $F(1, 39) = 4.31$, $p < .05$ ($MS_e = 16.46$).

Posttest means were evaluated using Dunn's multiple comparison procedure (Kirk, 1982). The LG-SE, LG-NoSE, and PG-SE conditions did not differ significantly but each scored higher than the PG-NoSE condition on self-efficacy (ps < .01 except $p < .05$ for the LG-NoSE/PG-NoSE comparison) and skill (all ps < .05). LG-SE students persisted longer than did PG-NoSE children ($p < .05$).

Goal Orientations

The LG-SE and LG-NoSE conditions demonstrated higher task orientation and lower ego orientation on the posttest compared with the pretest (range of $t(10)$ values = -3.09 to +2.78, ps < .05). PG-SE children showed a decline in ego orientation, $t(10) = -5.04$, $p < .01$.

MANCOVA applied to the four goal orientation scales using the corresponding pretest measures as covariates yielded significant effects for type of goal, Wilks's lambda = .633, $F(4, 33) = 4.78$, $p < .01$, and for self-evaluation, lambda = .512, $F(4, 33) = 7.87$, $p < .001$. The goal x self-evaluation interaction also was significant, lambda = .638, $F(4, 33) = 4.68$, $p < .01$.

ANCOVA applied to each measure using the corresponding pretest measure as covariate yielded significance on task orientation due to type of goal, $F(1, 39) = 13.08$, $p < .01$; the goal x self-evaluation interaction also was significant, $F(1, 39) = 4.99$, $p < .05$ ($MS_e = 108.54$). Ego orientation revealed significant effects for type of goal, $F(1, 39) = 7.85$, $p < .01$; for self-evaluation, $F(1, 39) = 19.70$, $p < .001$; and for the goal x self-evaluation interaction, $F(1, 39) = 10.90$, $p < .01$ ($MS_e = 60.03$). The LG-SE, LG-NoSE, and PG-SE conditions did not differ but each judged task orientation higher and ego orientation lower than did the PG-NoSE condition (ps < .01).

Instructional Session Measures

The number of problems children worked on during the instructional sessions was analyzed with a 2 x 2 analysis of variance (ANOVA) to determine the effects of treatments on children's motivation. Significant effects were obtained for type of goal, $F(1, 40) = 14.99$, $p < .001$, and for

self-evaluation, $F(1, 40) = 7.65$, $p < .01$, ($MS_e = 36.43$). LG-SE, LG-NoSE, and PG-SE children solved significantly more problems than did PG-NoSE students ($ps < .01$ except $p < .05$ for the PG-SE/PG-NoSE comparison). More rapid problem solving was not attained at the expense of accuracy; the four experimental conditions did not differ in the proportion of problems solved correctly (number of problems solved correctly divided by total number attempted).

Self-evaluation scores of the LG-SE and PG-SE conditions were compared for each of the six sessions. These analyses were nonsignificant.

Correlation/Regression Analyses

Product-moment correlations were computed among lesson performance (total number of problems attempted) and posttest measures (goal orientations, self-efficacy, skill, persistence). The number of problems that children attempted related positively to self-efficacy ($r = .53$), skill ($r = .51$), and persistence ($r = .42$), and negatively to ego orientation ($r = -.50$). Self-efficacy, skill, and persistence, were positively related (range of $rs = .63$ to $.89$). Task orientation related positively to self-efficacy ($r = .48$) and skill ($r = .42$); ego orientation correlated negatively ($rs = -.53$ and $-.45$, respectively) with these measures. Among LG-SE children self-evaluation scores correlated positively with posttest self-efficacy ($r = .74$) and persistence ($r = .77$).

Multiple regression was used to determine what portion of the variation in posttest skill was accounted for by pretest measures (self-efficacy, skill, persistence), experimental condition (as a categorical variable), number of problems attempted during the lessons, and posttest measures (self-efficacy, persistence). Predictors were entered one at a time in the preceding order (SPSS Inc., 1986). Significant predictors were posttest self-efficacy (49.5% of the variation, $p < .001$), experimental condition (17.3%, $p < .01$), and number of problems attempted during the lessons (12.1%, $p < .05$). Collectively, all seven predictors accounted for 81.3% of the variation in posttest skill (R^2 adjusted = .777). It should be noted that the greater contribution of posttest efficacy is partly artifactual because self-efficacy presumably is influenced by experimental condition and lesson performance.

Discussion

The present results show that giving students a learning goal with or without opportunities for self-evaluation or a performance goal with self-evaluation led to higher self-efficacy, skill, self-regulated performance during instruction, and task orientation, as well as lower ego orientation, compared with providing a performance goal without opportunities for self-evaluation. These findings cannot be due to differences in goal properties, because the learning and performance goals were comparable in proximity, specificity, and difficulty. These results also cannot be due to instructional differences between treatment conditions because students in all conditions received the same amount and type of instruction and problem solving.

One explanation for these findings is that emphasizing to students that their goal is to learn to solve problems can raise their initial sense of self-efficacy for learning and motivate them to regulate their task

performance and work diligently. Self-efficacy is substantiated as they observe their progress in skill acquisition. Higher self-efficacy helps to sustain motivation and increase skill acquisition (Schunk, 1991). In contrast, emphasizing to children that their goal is to solve problems will not result in the same initial sense of self-efficacy for learning. A lower level of efficacy for learning will not have beneficial effects on self-regulation or skill development. Having children periodically evaluate their capabilities makes it clear that they have made progress in learning, and this perception strengthens self-efficacy and keeps students working productively. Self-evaluation is especially important under performance goal conditions.

It is interesting that providing children with a learning goal or allowing them to evaluate their capabilities raised task orientation and lowered ego orientation. These results support the Meece et al. (1988) findings that students emphasizing task-mastery goals report active cognitive engagement characterized by self-regulatory activities and that motivation to learn is positively associated with goals stressing learning and understanding. It seems likely that learning goals and self-evaluation help focus children's attention on task progress and capabilities for learning (Schunk, 1990; Schunk & Swartz, 1993). Self-comparisons of present with past performances to determine progress constitute an integral component of a task orientation (Ames, 1992; Wentzel, 1992). Performance-goal children who did not evaluate their skills may have been less apt to focus on their learning progress, which would not have raised task orientation. In classrooms, performance goals can increase social comparisons and ego orientation as students attempt to determine their progress relative to that of peers (Jagacinski, 1992).

The hypothesis that combining learning goals with self-evaluation would raise achievement outcomes better than either factor alone was not supported except for persistence: LG-SE children persisted significantly longer solving posttest problems than did PG-NoSE students. This finding is noteworthy because persistence is an important component of self-regulation (Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1992). Over a longer period, increased persistence would be expected to benefit self-efficacy and skill (Schunk, 1989, 1990).

The lack of greater effects due to the combination of learning goals and self-evaluation may have resulted because the subjects were average achievers and moderately efficacious about learning. By itself, either treatment may have been sufficient to convey learning progress and raise self-efficacy and motivation. This combination might exert stronger effects among students who previously have encountered difficulties acquiring mathematical skills and who lack a sense of efficacy for learning. In support of this point, Schunk and Rice (1991) found that combining a goal of learning a reading comprehension strategy with feedback linking strategy use with better performance raised self-efficacy and skills better than did a learning goal alone among students with reading problems.

These results must be qualified because students were acquiring skills and self-evaluations were positive. Self-evaluation may not always have desirable effects. Asking students to periodically assess their capabilities on a task they repeatedly have failed will lower self-efficacy and motivation; after many negative attempts students are likely to conclude they are

incapable of learning. Students with learning problems often fall into a cycle in which failure leads to negative self-perceptions, diminished motivation, and further failure (Licht & Kistner, 1986). To be effective, self-evaluation must be linked with effective instruction so students will learn and perceive they are making progress.

This study supports the idea that self-efficacy is not merely a reflection of prior performances (Bandura, 1986). PG-NoSE students attempted fewer problems during instructional sessions but their proportion of problems solved correctly matched that of the other conditions. This research also shows that capability self-perceptions bear a strong relation to achievement. Personal expectations for success are viewed as important influences on achievement by different theoretical approaches (Bandura, 1986, 1989; Covington, 1987; Weiner, 1985).

These results have implications for mathematics teaching. Learning goals can be easily incorporated into regular classroom instruction. Among children who are cognitively capable of evaluating their capabilities, self-evaluation may be a useful addition to testing as a means of assessing students' skills and of providing information to use in designing instruction. Although learning goals and self-evaluation are not necessary for all classroom activities, the present results suggest that, when combined with a sound instructional program, they facilitate self-regulated learning and achievement outcomes.

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Table 1

Means (and Standard Deviations)

		Experimental Condition			
Measure	Phase	LG-SE	LG-NoSE	PG-SE	PG-NoSE
Self-Efficacy	Pretest	44.8	39.3	40.8	43.1
		(8.4)	(17.4)	(15.2)	(14.8)
	Posttest	85.3	81.0	87.9	64.6
		(9.9)	(16.3)	(9.1)	(11.8)
Skill	Pretest	2.8	3.0	3.0	2.6
		(3.6)	(3.4)	(3.3)	(3.1)
	Posttest	14.1	13.2	13.8	8.5
		(3.8)	(4.3)	(3.8)	(3.7)
Persistence	Pretest	9.0	8.5	8.5	9.2
		(2.4)	(3.0)	(3.4)	(3.1)
	Posttest	13.0	10.2	11.2	9.0
		(3.6)	(4.1)	(5.3)	(3.0)
Task Orientation	Pretest	86.5	86.2	86.6	82.2
		(9.1)	(11.6)	(10.5)	(16.4)
	Posttest	94.0	94.9	89.6	74.4
		(6.8)	(7.7)	(10.2)	(19.3)
Ego Orientation	Pretest	94.5	91.3	91.4	92.1
		(11.9)	(10.7)	(10.2)	(10.4)
	Posttest	80.7	82.9	79.1	97.3
		(4.9)	(8.5)	(10.4)	(6.1)
Affiliative Orientation	Pretest	77.5	81.7	80.8	72.3
		(11.3)	(18.9)	(16.8)	(21.5)
	Posttest	65.4	73.0	73.7	64.5
		(17.6)	(22.0)	(19.3)	(31.9)
Work Avoidant Orientation	Pretest	30.7	31.8	40.7	38.5
		(15.2)	(18.4)	(30.1)	(17.3)
	Posttest	30.7	40.5	40.0	40.7
		(19.1)	(21.4)	(23.9)	(19.5)
No. of Problems Completed	Lessons	39.1	36.6	34.6	27.0
		(8.3)	(4.1)	(7.0)	(3.1)
Self-Evaluation	Lessons	93.3	---	88.3	---
		(4.4)	---	(11.3)	---

Note. N = 44; n = 11 per condition. Self-efficacy scores represent the average judgment per problem; range of scale is 10 (low) to 100. Skill means represent the number of correct solutions on 31 problems. Persistence scores are total number of min spent solving 31 problems. Goal orientation means represent average scores; range is 10 (low) to 100. Number of problems completed is the average number completed per instructional session. Self-evaluation means represent average scores; range is 10 (low) to 100.